APPLICATION FOR PATENT

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Title: Infrared communications link with attachment configuration.

FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to infrared communications links and, in particular, it concerns infrared communications links with attachment configurations and their applications in digitizer systems.

Many devices are now equipped with infrared interface ports, such as desktop computers, portable computers, printers, personal digital assistants (PDAs), digital cameras, personal communication services (PCS) handsets, and the like. Infrared communications work best when an infrared interface port of the transmitting device is aligned within 15° (up, down, left or right) of an infrared interface port of the receiving device. As long as the infrared interface port is aligned within this 30° cone, connectivity will occur at reasonable distances (typically up to 3 meters). In practice, it is difficult to align the devices within the allowable link angle and distance. The problem is magnified for relatively heavy infrared compatible desktop computers or printers with less mobility than portable computers since the infrared interface ports of the respective devices are fixed to the housings, and the optical axes of the infrared interface ports are normal to the surface of the housings. The problem is also magnified when trying to align infrared interface ports when the user is travelling or other circumstances where the devices may be in constant motion.

Of most relevance to the present invention are U.S. Patents No. 6,128,117 to Kim, No. 5,343,319 to Moore, No. 5,668,654 to Benjamin et al. and No. 5,999,996 to Dunn. The above patents discuss creating a link to a first device having an infrared interface port using an external infrared interface port which is connected to a second device by a communications cable.

A shortcoming of the aforementioned systems is due to the external infrared interface port having to be held against the infrared interface port of the first device by the user in order to maintain the infrared communications link. This is especially impractical when the infrared interface port of the first device is not next to a flat surface or when the devices are frequently being moved around, such as when the user is working while travelling.

There is therefore a need for an infrared communications link in which the components can be more conveniently and effectively maintained in a desired alignment.

SUMMARY OF THE INVENTION

The present invention is an infrared communications link that includes an attachment configuration.

According to the teachings of the present invention there is provided, a communications link between a processing device having an infrared port and a second device, comprising: (a) an attachment configuration for attachment to a device; (b) an infrared interface, wherein the infrared interface is mechanically connected to the attachment configuration; and (c) a communications cable,

wherein the communications cable is operationally connected to the infrared interface.

According to a further aspect of the present invention there is provided an infrared communications link comprising a processing device having an infrared port; and the communications link described above, wherein the attachment configuration is configured for attachment to the processing device and the infrared interface is maintained in optical alignment with the infrared port.

According to a further aspect of the present invention the attachment configuration is formed as a clip.

According to a further aspect of the present invention the attachment configuration is formed as a unitary flexible clip having at least two clamping surfaces.

According to a further aspect of the present invention the attachment configuration includes an upper clamping portion, a lower clamping portion and a biasing element; and the biasing element is mechanically connected to the upper clamping portion and the lower clamping portion.

According to a further aspect of the present invention the communications cable includes an optical fiber.

According to a further aspect of the present invention the communications cable includes an electrically conducting wire.

According to a further aspect of the present invention there is also provided an electrical plug configured for attachment to the second device,

wherein the electrical plug is electrically connected to the communications cable.

According to a further aspect of the present invention the infrared interface includes a power source.

According to a further teaching of the present invention there is provided a method to link a first device having an infrared port to a second device comprising the steps of: (a) providing a communications cable having a first end terminating in an infrared interface; and (b) attaching the infrared interface to the first device to maintain the infrared interface in optical alignment with the infrared port.

According to a further aspect of the present invention the step of attaching is performed by using a clip.

According to a further aspect of the present invention: (a) the step of attaching is performed by using an attachment configuration that includes an upper clamping portion, a lower clamping portion and a biasing element; and (b) the biasing element is mechanically connected to the upper clamping portion and the lower clamping portion.

According to a further aspect of the present invention the communications cable includes an optical fiber.

According to a further aspect of the present invention the step of providing is performed by providing an electrically conducting communications cable having a first end terminating in an infrared interface and a second end terminating in an electrical plug; and further comprising the

step of connecting the electrical plug to an electrical interface of the second device.

According to a further teaching of the present invention there is provided a method to prevent interference between infrared signals of different devices, the devices including: a processor input device having a first section and a second section, wherein the first section has a first infrared interface and an external infrared interface and the second section has a second infrared interface; and a processing device having an infrared port, the method for operating comprising the steps of: (a) sending first signals between the first infrared interface and the second infrared interface; and (b) sending second signals between the external infrared interface and the infrared port; wherein time multiplexing is established between the first signals and the second signals.

According to a further aspect of the present invention the second infrared interface is configured for transmitting only.

According to a further aspect of the present invention there is also provided the steps of: (a) forming the second signals according to a system of data encoding; and (b) forming the first signals to be void of data content according to the system of data encoding.

According to a further aspect of the present invention there is also provided the step of forming the first signals so as to appear void of data content to the processing device.

According to a further aspect of the present: (a) the processor input device is a digitizer system; (b) the first section is a base unit of the digitizer system; (c) the second section is a moveable element with a stylus; and (d) the digitizer system records the movement of the stylus.

According to a further aspect of the present invention the stylus is configured to write on a substrate.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is herein described, by way of example only, with reference to the accompanying drawings, wherein:

Fig. 1 is a schematic isometric view of an infrared communications link between two infrared interface ports that is constructed and operative in accordance with a preferred embodiment of the invention;

Fig. 2 is a schematic isometric view of an infrared communications link between a first device having an infrared interface port and a second device having an electrical interface port that is constructed and operative in accordance with a most preferred embodiment of the invention;

Fig. 3 is an isometric view of an external infrared interface port with a attachment configuration forming part of the infrared communications link of Fig. 1 and Fig. 2;

Fig. 4 is a plan view of the external infrared interface port with the attachment configuration of Fig. 3;

Fig. 5 is a front view of the external infrared interface port with the attachment configuration of Fig 3;

Fig. 6 is a side view of the external infrared interface port with the attachment configuration of Fig. 3;

Fig. 7 is a schematic representation of the operation of a system using the infrared communications link of Fig. 1 or Fig. 2;

Fig. 8 is a schematic representation of the operation of a timing system for preventing interference of infrared signals of related devices constructed and operative in accordance with an alternate embodiment of the invention;

Fig. 9 is a schematic representation of the operation of the system of Fig. 8 operating in a power saving mode.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is an infrared communications link with attachment configuration. The invention also provides applications of such communications links in digitizer systems.

The principles and operation of the infrared communications link with attachment configuration according to the present invention may be better understood with reference to the drawings and the accompanying description.

By way of introduction, the infrared communications link of the present invention has two main configurations. The first configuration is an optical link with an infrared interface at each end of the link, to be discussed with reference

to Fig. 1. The second configuration is an electrical link with an infrared interface at one end of the link and an electrical plug at the other end thereof, to be discussed with reference to Fig. 2.

Reference is now made to Fig. 1, which is a schematic isometric view of an infrared communications link **10** between two devices having infrared communications ports that is constructed and operative in accordance with a preferred embodiment of the invention. An electronic device **15** has an infrared communications port **20** and an electronic device **25** has an infrared communications port **30**. Infrared communications port **20** is linked to infrared communications port **30** by infrared communications link **10**. Infrared communications link **10** includes a communications cable **35**, two infrared interfaces **40** and two attachment configurations **45.** Each one of infrared interfaces **40** is connected to opposing ends of communications cable **35**. Each one of attachment configurations **45** is mechanically connected to a separate infrared interface **40**. Communications cable **35** is typically an optical fiber cable, including at least one optical fiber. Each infrared interface **40** is maintained in optical alignment with infrared communications ports **20, 30** by attaching attachment configurations **45** to electronic device **15** and electronic device **25** respectively. Attachment configuration **45** is typically a clip, which can open and close to fit many sizes of electronic devices. Attachment configuration **45** is configured for quick and secure attachment to electronic device **15** and quick detachment therefrom. The most preferred embodiment of attachment configuration **45** will be described below in reference to Figs. 3 to

7. However, it should be noted that attachment configuration **45** could take other forms, such as a suction based device to secure infrared interface **40** to electronic device **15** or electronic device **25**.

Reference is now made to Fig. 2, which is a schematic isometric view of an infrared communications link **50** between an electronic device **55** having an electrical port **60** and an electronic device **65** having an infrared communications port **70** that is constructed and operative in accordance with a most preferred embodiment of the invention. Infrared communications link **50** includes a communications cable **75**, infrared interface **40**, an electrical plug **60** and attachment configuration **45.** Infrared interface **40** is connected to one end of communications cable **75** and electrical plug **60** is electrically connected to the other end of communications cable **75.** Attachment configuration **45** is mechanically connected to infrared interface **40**. Communications cable **75** is typically an electrically conducting wire. Infrared interface **40** is attached to electronic device **65** using attachment configuration **45**.

Reference is now made to Figs. 3 to Figs. 6, which are various views of infrared interface **40** with attachment configuration **45** forming part of the infrared communications link of Fig. 1 and Fig. 2. As described above with reference to Fig. 1, infrared communications link **10** is an optical link with an infrared interface **40** at each end of communications cable **35**. As described above with reference to Fig. 2, infrared communications link **50** is an electrical link with an infrared interface **40** at one end of communications cable **75**. Infrared interface **40**, when used with infrared communications link **10** or

infrared communications link **50,** includes a lens **80** for focusing light received by infrared interface **40** or dispersing light transmitted by infrared interface **40**. For use with infrared communications link **50**, infrared interface **40** also includes an infrared transmitter **82**, shown schematically, associated transmission circuitry (not shown), an infrared receiver **83**, shown schematically and associated receiving circuitry (not shown). Infrared transmitter **82**, associated transmission circuitry, infrared receiver **83** and associated receiving circuitry are all disposed in the infrared interface behind lens **80**. Infrared transmitter **82** is typically a light emitting diode and infrared receiver **83** is typically a photodiode. Transmission circuitry and receiving circuitry are omitted from the infrared interface **40** if their function is provided by first electronic device **55** (Fig. 2). Infrared interface **40** also includes a power supply (not shown), which is typically a battery. The power supply is stored in a power supply compartment **85** typically being an elongated hollow cylindrical member between the back of attachment configuration **45** and lens **80**. Infrared interface **40** also includes a socket **90** to connect infrared interface **40** with communications cable **75** (Fig. 2).

Attachment configuration **45** is typically a clip, which can open and close to fit many sizes of electronic devices. Typically, the clip is configured to open from 9 mm to 25 mm. Attachment configuration **45** has an upper clamping portion **95**. Upper clamping portion **95** is formed from a bent substantially rectangular plate. Upper clamping portion **95** has two flat edges, a front edge and a back edge. The front edge of upper clamping portion **95** is

mechanically connected to a rubberized ridge **100**. The back edge of upper clamping portion **95** is connected to a biasing element **115**. Attachment configuration **45** has a lower clamping portion **105**, which is a substantially flat plate. The front edge of lower clamping portion **105** is mechanically connected to a rubberized ridge **110**. The back edge of lower clamping portion **105** is connected to biasing element **115**. Rubberized ridges **100**, **110** prevent the attachment configuration **45** from slipping off electronic device **65** when attached thereon. Biasing element **115** is mechanically connected to power supply compartment **85**. Biasing element **115** is formed as a substantially rectangular plate bent to a curve. Biasing element **115** is resilient enough to enable securing device **45** to open and close to fit many sizes of electronic devices while ensuring securing device **45** will remain attached to the electronic device. It should be noted that either one or both of upper clamping portion **95** and lower clamping portion **105** are typically resilient in order to perform the same function as biasing element **115**. The front edges of upper clamping portion **95** and lower clamping portion **105** are typically shorter than the axial length of power supply compartment **85**. The above is to help maintain infrared interface **45** in optical alignment with infrared communications port **70** of electronic device **65.** Upper clamping portion **95**, lower clamping portion **105** and biasing element **115,** are typically formed from molded plastic and are typically formed as one piece.

Reference is now made to Figs. 7 to 9. By way of introduction, certain devices, for example digitizer systems, have internal operating systems that use

infrared signals as a method of communication between various elements of the system. A digitizer system typically communicates with an external device such as desktop computers, portable computers, personal digital assistants (PDAs), digital cameras, personal communication services (PCS) handsets, and the like. Communication between a digitizer system and an external device typically use the infrared communications ports of both devices to avoid problems caused by conventional electrical connections mentioned above. The above solution however, leads to the problem of aligning the infrared communications ports of the digitizer system and the external device. Additionally, there is a problem whereby the internal infrared signals of the digitizer or similar system may interfere with the external signals between the digitizer or similar system and the external device. An example of a digitizer system is a tracking system for an electronic pen or stylus, where the electronic pen communicates with a base unit using infrared signals alone or in combination with ultrasound signals or other communications method. The base unit also communicates with an external device such as a personal digital assistant (PDA) using infrared signals to record the movements of the electronic pen or stylus.

In the above regard, reference is now made to Fig. 7, which is a schematic representation of the operation of a system using the infrared communications link of Fig. 1 or Fig. 2. A device **130**, for example a digitizer system, has two sections **135** and **140**. For example, section **135** is a base unit of the digitizer system, and section **140** is an electronic pen of the digitizer

system, configured to write on a substrate. Section **135** has two infrared interfaces **142** and **143**. Section **140** has an infrared interface **144**. A device **145**, for example a personal digital assistant, has an infrared interface **147**. Signals **148** are transmitted between infrared interface **142** and infrared interface **144**. Signals **149** are transmitted between infrared interface **143** and infrared interface **147**. The term 'transmitting between' mentioned above means bi-directional. Problems of interference typically occur between signals **148** and signals **149**. In other words, device **130** and device **145** are receiving signals **148** or signals **149** or a combination thereof. The problem is made more difficult to solve, when infrared interface **144** must have a 360° angular communications range as in the case where section **140** is an electronic pen. Also, there are typically problems aligning infrared interfaces **143** and **147**. The problem of interference can be avoided by using a number of techniques to be described hereafter. These techniques may be used independently or in combination. The first technique to avoid the problem is by using infrared communications link **50**, shown schematically, which links infrared interface **143** and infrared interface **147** and therefore physically separates signals **148** and signals **149**. Infrared communications link **10** (Fig. 1) can be used instead of infrared communications link **50**.

Reference is now made to Fig. 8, which is a schematic representation of the operation of a timing system for preventing interference of infrared signals of related devices constructed and operative in accordance with a most preferred embodiment of the invention. As a second technique to prevent

problems of interference that typically occurs between signals **148** and signals **149**, a timing system **150** establishes time multiplexing between signals **148** and **149**. Time multiplexing ensures that only one of signals **148** and signals **149** are transmitted and received at any given time. Timing system **150** is operated by device **130** and is typically forms part of section **135**. Timing system **150** is typically operated according to the following protocol. Signals **148** are transmitted by infrared interface **144** according to a periodic timing schedule having an interval between transmissions of time *t*. Signals **149** will be transmitted by infrared interface **143** after transmission of signals **148** are complete and for a duration less than time *t*.

As a third technique to prevent problems of interference that typically occur between signals **148** and signals **149**, infrared interface **143** is positioned in such a way, that infrared interface **143** cannot receive or blocks signals **148**. The blocking of signals **148** is typically achieved by reducing the angular communications range of infrared interface **143** to less than 180° and aiming infrared interface **143** suitably. It should be noted that infrared interfaces **142**, **143** and **147** typically have an angular communications range of less than 180°. More specifically, infrared interfaces **143** and **147** will typically have an angular communications range of between 20° to 30°. In addition, infrared interface **142** is positioned in such a way, that infrared interface **142** cannot receive signals **149**. In addition, infrared interface **144** only acts as a transmitter of signals **148** and therefore cannot receive signals.

As a fourth technique to prevent problems of interference that typically occur between signals **148** and signals **149**, signals **148** are formed so as to appear void of data content to device **145**. This can typically be achieved if signals **149** are formed according to a system of data encoding used by device **145** and signals **148** are formed to be void of data content according to the system of data encoding. Therefore, signals **148** are analyzed by device **145** and then disregarded, or signals **148** are simply disregarded without any prior analysis by device **145**, as it has no data content relevant to device **145**.

Reference is now made to Fig. 9, which is a schematic representation of the operation of the system of Fig. 8 operating in a power saving mode. By way of introduction, portable devices such as digitizer systems, portable computers, personal digital assistants (PDAs), digital cameras, personal communication services (PCS) handsets, and the like normally operate using a rechargeable power supply or battery. Infrared communications use a significant amount of energy. Therefore, it is preferable to reduce the infrared communications to the minimal required. This can be achieved by infrared interface **143** only acting as a transmitter of signals **149** and therefore cannot receive signals. In addition, infrared interface **147** only has to act as a receiver of signals **149** and not as a transmitter.

It will be appreciated by persons skilled in the art that the present invention is not limited to what has been particularly shown and described hereinabove. Rather, the scope of the present invention includes both combinations and sub-combinations of the various features described

hereinabove, as well as variations and modifications thereof that are not in the prior art which would occur to persons skilled in the art upon reading the foregoing description.